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Impedance spectroscopic monitoring of the effect of phytochemical compounds on wound healing in microfluidics

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Wound healing (WH) is a complex well-coordinated and regulated cascade of events taking place without further complication in healthy individuals while abnormalities often occur in patients with diabetes, severe infections or persons with vitamin or mineral deficiencies [1].
Phytochemical compounds (PCCs), plants and extract from plants, honey and bee propolis, have been proved to have beneficial effect of WH processes [2,3]. Several PCCs has been proved to have anti-inflammatory [4,5] and antioxidant [6,7] effect on WH. It has been shown that medicinal plants induce activation of growth factors and extracellular matrix deposition [8] as well as cells migration and proliferation [9]. However, there is a need for scientific validation, standardization [10] and extensive studies for the understanding and elucidation of the mechanism of action of PCCs.
To study complex biological problems such as WH and elucidate the effect of PCCs on this process, thus finding new ways for treatment, there is a need for new technologies that enable simultaneous multi-parameter detection. In this project we combine the advantages provided by microfluidics cell culturing [11] and electrochemical detection [12]. Electrochemical (bio)sensors have proven to be both sensitive and selective [13] and at the same time to enable detection without destroying cellular integrity. Integration of electrode arrays with a microfluidic cell culture device will allow dynamic real time monitoring of cell proliferation and migration based on impedance spectroscopy [14-16] as well as intracellular redox status using amperometric detection [17,18].
By measuring cell proliferation and changes in redox status of model cell lines (e.g. fibroblast) during WH in wounds induced mechanically (Figure 1) of by UV, we are able to learn more about the effect and role of PCCs on WH processes.

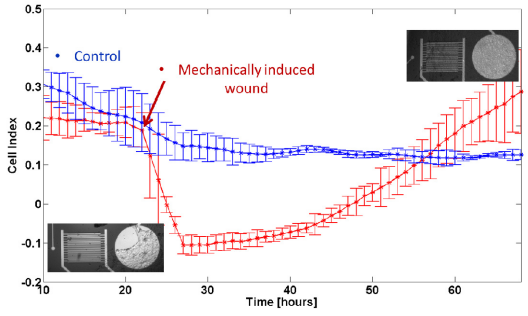

Figure 1. Impedance tracking of wound 'healing' process during mechanically induced wound using fibroblasts

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